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Abstract

The relationship between the macroeconomic factors and the stock market has always been in the focus of economic research. Based on the previous literatures and theories, and using econometric methods, such as Granger causality test, cointegration analysis, impulse response analysis, together with the latest data we want to find the relationship between stock market and macroeconomic factors in China. In this thesis we consider three factors, GDP, interest rate and money supply. We conclude that there is evidence for a dynamic interaction between stock market and macroeconomic variables in China.

Keywords: Stock index; GDP; M1; Interest rate; Cointegration

Zusammenfassung

Die Beziehung zwischen den makroökonomischen Faktoren und dem Börsenmarkt ist immer im Mittelpunkt der wirtschaftlichen Forschung. Basierend auf den bisherigen Literaturen und Theorien, und mit ökonometrischen Methoden, wie z.B. Granger-Kausalitäts-Tests, Kointegrationsanalyse, Impulsantwort Analyse, wollen wir mit den neuesten Daten die Beziehung zwischen den makroökonomischen Faktoren und dem Börsenmarkt in China finden. In dieser Arbeit betrachten wir drei Faktoren, und zwar BIP, Zinssatz und Geldangebot. Wir finden in dieser Arbeit, dass es Hinweise auf Wechselwirkungen zwischen Aktienmarkt und makroökonomischen Variablen in China gibt.

Schlüsselwörter: Aktienindex; BIP; Geldangebot; Zinssatz; Kointegration

1. Introduction

1.1. Background

As an important part of the financial market, the stock market has a strong relationship with economic growth. From this point we could also say that there is a strong relationship between stock market and macroeconomic factors. Normally we say that the stock market is a barometer of the economy. Many authors, like Demirguc-Kunt and Levine (1996), Rigobon and Sack (2003), Yang (2009) among others, also point out that there are higher correlations between stock market and macroeconomic factors in countries with a developed stock market, such as USA, UK. However, this is still a controversial issue in China where the stock market is still developing.

In the year 1990 the Shanghai Stock Exchange was founded. The Shenzhen Stock Exchange followed in the next year, which was an important milestone in the history of the Chinese stock market. From then on there is real stock market for entire China. The stock market also became an important factor for the Chinese economy. In the last 20 years, the stock market in China has been expanding and accelerating. By the end of March 2011, the number of listed companies in China had reached 2148, with circulation market value reaching 21 trillion RMB Yuan. The stock market has also become an important part of the Chinese economy, and effects of economic policy may depend on changes of stock market.

There are many potential influence factors on the price for stock, such as interest rate, exchange rate, deposit, investment and inflation and so on. In this paper we only consider the effects of interest rate, money supply and GDP on the index of stock market. GDP is always the most important economics index of the country; interest

rate and money supply are not only instruments of monetary policy but they also reveal the supply-demand relationship of the capital. The stock index can reflect the works of the stock market very well, so we study the relationship between these three macroeconomics variables and the stock index.

At last of this section I want to say that some authors also write the similar paper like this one and may also use same variables. However, there are many questions[1] in those papers and may confuse us. We try to avoid these mistakes and do the right test to find the more reliable result in this paper.

1.2. Related Literature

The stock market has been receiving more and more attention recently. More and more Chinese scholars work on financial area, and the stock market is already an important issue in the Chinese mass media. Many economists have been studying the relationship between stock market and economic growth. We survey some literature within this field in the following.

1.2.1. The Relationship between Stock Market and Economic Growth

Goldsmith (1969) opened the door of research on relationship between stock market and economic factors.[2] After this paper, more researchers began to focus on this study field. There are two conceptions:

The first viewpoint is there is a positive relationship between stock market and economic growth.

[1] For example, they may use wrong model or make mistake by data processing.

[2] Goldsmith R. W. Financial Structure and Development. Yale University Press. 1969

By using U.S. data in the time period from 1953 to 1987, Eugene Fama (1990) pointed out that there is a significant positive correlation between the stock return and growth rate of the output in the future. Fama believed that investors' expectations on the future level of cash flow can affect the price of stock right now. Ross Levine (1996) pointed out there is a relationship between GDP per capita and development level of stock market. This means that a greater GDP per capita corresponds to a higher development level of the stock market. Yang (2008) points out that there is a positive relationship between stock market and economic growth in long time period in China. The change of economic growth is a big impact factor on stock market.

The second viewpoint is that there is little correlation or even no relationship between stock market and economic growth.

Harris (1997) said the relationship between development level of stock market and economic growth rate is very weak. It is not significant statistically. The test result reveals that the stock market and macroeconomic correlate positively in developed countries, but not significantly in developing countries. A stronger relationship between stock market and the macro-economy corresponds to a higher maturity level of the stock market. Conversely, if the relationship is weak or no correlation, this may indicate that the stock market is immature. Some economists think that the stock market is inefficient and we have not enough evidence to prove that the stock market affects the GDP growth (Harris (1997)). For the situation in China, Li (2006) pointed out that the stock market can reflect partly the economic level in long period, but in the short run the stock market may not be the barometer of the economy.

Some authors find a cointegration relationship between the stock market index and macroeconomic factors when the stock market is close to mature. Otherwise, if there

is no cointegration relationship between the stock market and macroeconomic indicators, this indicates that this stock market is still immature.

1.2.2. The Relationship between Stock Price and Money Supply

Regarding OECD countries, most researchers found that there is a positive correlation between movements in the stock price and in the money supply, which means that the stock price will go up when increasing money supply.[3] Rozeff (1984), Friedman (1988), and Pally (1995) had the same result that the positive correlation between stock price and money supply is significant, and at the same time they also pointed out that change of money supply can affect the return of stocks.

Chinese researchers obtain similar results for the Chinese stock market. Liu and Shen (2008) studied the relationship between the money supply and stock market index in China empirically and pointed out that M1 has a larger effect than M2 for Chinese stock market, as most investors in China are small investors and the government can more easily control the rate of increase for M1, to adjust the stock market.

1.2.3. The Relationship between Stock Price and Interest Rate

The interest rate is one of the most important tools to adjust the money supply, for example the central bank increases the money supply by lowering certain interest rates. For this relationship the same method with different samples yields different results. Fama (1990) used a sample for the time period 1953 to 1987 and found that the variation of industrial production and interest rate can explain about 58% of the variation of the returns of stock market every year. But by using the same method with the sample in longer period (1889-1998) he could not find the same result. For

[3] Friedman Milton. Money and the Stock Market. Journal of Political Economy. 1988(96), 21-24

this longer time span, there is no significant correlation between variation of interest rate and stock price.

With the development of econometric methods more and more researchers have interest in the relationship between sudden changes of interest rate and macroeconomic factors. Bernanke and Kuttner (2005) found that the stock market has strong response to the changes of federal fund rate which the investors could not predict. By contrast, the stock market has weak response to predicted changes of the federal fund rate.

The Chinese researchers have also heterogeneous results. Some of them found that there is a significant correlation between stock price and interest rate, as the stock market reacted sensitively to interest rate cuts. Tang and Li (2000) point out that the Chinese stock market has reacted sensitively to decreases in the interest rate, but not every interest rate cut leads to an increase in stock prices. By contrast, for all previous interest rate decreases the stock market had different responses. In other words, sometimes the interest rate cut leads to a decrease in stock prices. This conflicting evidence may indicate that there are more factors which can affect the stock price (Tang and Li 2000). Gao (2004) pointed out that there is strong correlation between interest rate and stock price, especially in the recent years. Li (2008) found that there is no doubt that a decreasing interest rate is good news for the stock market and that its increasing is bad. However, other researchers found no relationship between the interest rate and the stock price. For example, Jia (1999) argued that an increasing interest rate can lead the decreasing of financing cost, but that the overproduction is difficult to sell because the demand is at the low level.

1.3. Problems in the Existing Literature

The literature review above shows that there are many different research results for OECD economies as well as for China. In summary, we can identify three main points:

First, most traditional research focuses on mature stock markets, but the Chinese stock market is still young and growing up. Thus, some of these results from OECD papers may not be suitable for Chinese stock market.

Second, the Chinese stock market is growing up quickly. The statistical numbers are updated frequently. The results from earlier papers might not be suitable for the present situation.

Third, different methods[4] can lead to different results, and thus we should also standardize the research method and data.

1.4. Structure

The first part of this paper is an introduction of the topic and brings some background information. The second part is theoretical analysis. We analyze three relationships by economic theory and we arrive at theoretical conclusions. In the third part we describe the relationship between stock index and other statistical data in the past. The fourth part is empirical analysis. We set the model, and we conduct unit root tests, Granger causality test and impulse response analysis, among others. We conclude the paper in the fifth part.

[4] We found there is a cointegration between our variables and we should do VECM under this result, but some papers (Yang (2009)) still use VAR model. It should be wrong.

2. Theoretical Analysis

There are lots of factors leading to the change of stock prices, such as politics, natural calamity and so on. Those factors, however, work normally only in short period or can affect only a part of stock markets. By contrast, the macroeconomic factors can affect almost every single share, namely, the total stock markets. Many researchers say that the change of the stock market index and bond market index could be affected by the following macroeconomic factors, among others: GDP growth rate, interest rate and money supply. In this paper we investigate whether those three factors, GDP, interest rate and money supply, have effects on the stock market index as outlined in the following subsections.

2.1. The Effect of Interest Rate

The interest rate is an important indicator for the stock markets. Every time the central bank adjusts the interest rate, or the investors revise their expectations of interest rates, this will create fluctuations in the stock markets. The interest rate can affect the stock market in two ways:

First, when the interest rate increases, the profit of the firms will decrease. There are two reasons: first, the firms normally update old debt and issue new debt continuously. When the interest rate increases the debt, which the firm should pay for, will also increase. Second, a higher interest rate reduces economy activity. With the higher interest rate the firms will decrease their investment in setting up new factories or buying new machines, and then the profit of the firms, which sell machines or build the factories, will also decrease. Moreover, consumers often buy cars or houses with mortgage. If the interest rate increases, the consumption will go down. This

means the sales of the firms go down and then the profit of the firms must also go down, after this all, the price of firm's share will decrease.

Second, when the interest rate rises, other assets than stocks, such as bonds or saving, become more attractive.

Thus we conclude that in the long run the interest rate and the index of the stock market should be negatively related.

2.2. The Effect of GDP

GDP is always the most important macroeconomic indicator for a country. When GDP decreases, the economy is said to experience a recession. Then, the profits of most listed companies are not good. The firms will decrease investment to keep the cost on a low level. The listed company is the supply side of the stock markets. If their financing rate decreases, the supply curve will shift to the left. At the same time, the demand side (investors) has lower expectation of return, so they will take the money from the stock markets and make the demand curve shift to the left. Otherwise if the economy works very well, namely, GDP increases quickly, that means the investors have better return expectations and will invest more money in the stock markets. In other words, the demand of shares will increase. Firms will expand investment simultaneously. They will issue more shares to get money. Then the supply of the shares will also increase. So the supply and demand of the shares will increase simultaneously.

However when both of the demand and supply curves move in the same direction, we cannot easily conclude whether the price will increase or decrease depending on the magnitude of their movement.

2.3. The Effect of Money Supply

For the theoretical part there are three possibilities which can affect the price of the stock. The first one is the expectation effect. When the central bank prepares to implement a restrictive monetary policy or expansionary monetary policy, then the investors will adjust their expectations for the future currency markets and change the investment quantity on the stock markets. This action, in turn, will affect the price of the stock markets. The second one is the portfolio effect. When the central bank makes an expansionary monetary policy, the currency quantity held by investors will increase. They will tend to use their unplanned saving to purchase assets in the stock markets to get more profit. The third one is the increase in the internal value of shares. When the money supply increases, the interest rate will decrease and investment cost decreases simultaneously. The firms will do more investment. Those actions will increase the profit of the firms and increase the price of the stock markets at the same time. For this reason, it is plausible to expect that movements in the money supply and the index of the stock market will be positively correlated.

3. The Relationship between China's Stock Price Index and other Statistical Analysis

3.1. Summary of the Trend of Shanghai's Stock Index

Figure 1: Shanghai Index Trend

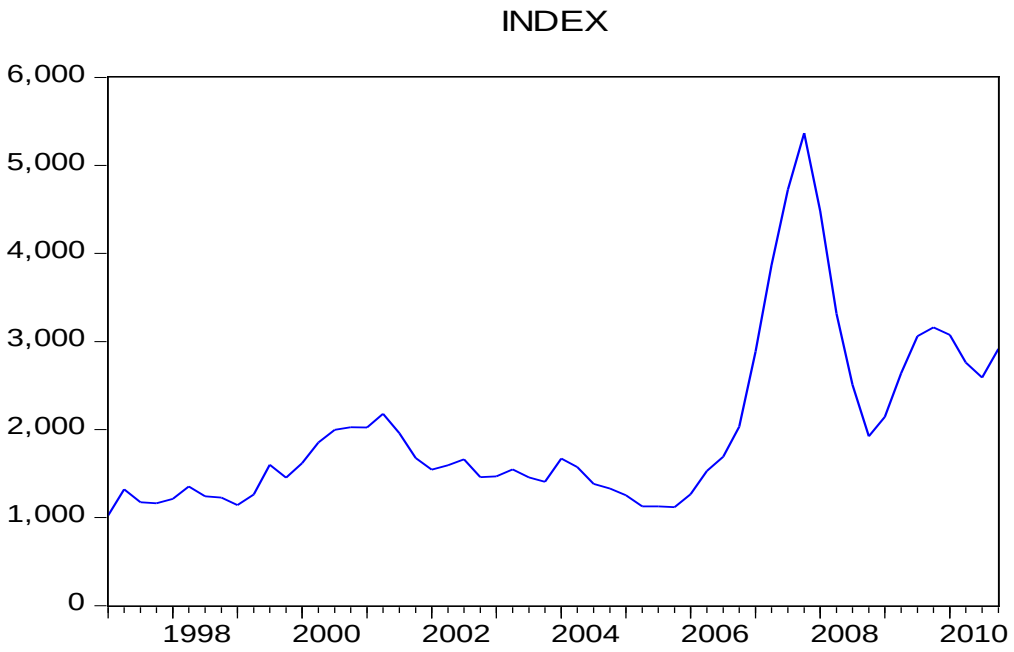

Figure 1 shows the moving status of the stock index for Shanghai Stock Exchange from the year 1997 to 2010. In the following text we will discuss the development of it over the time.

3.1.1. 1997 Q1 to 1999 Q2

In the second half year of 1997 the Asian financial crisis totally exploded. In 1998 there were strong disastrous floods in China. In this period the Chinese stock markets underwent a big adjustment phase. The number of the new listed companies, the amount of financing, the volume of transactions and stock price were all on a decline.

During 1997 new listed companies numbered only 106. From January to May in 1999, there were only 33 new listed companies. In 1998, the volume of transactions decreased by 30% relative to the previous year.

3.1.2. 1999 Q2 to 2001 Q2

Figure 1 shows that from the second quarter of 1999 to second quarter of 2001 the stock index kept increasing obviously. At the beginning of 1999, China had slow economic growth and there was deflation. The Chinese government implemented some expansionary policies to stimulate the stock markets and in order to create more consumption and investment. In May 19, 1999, the management team which is CSRC (China Securities Regulatory Commission) proposed a series of political advices and this information brought a big shock in the market. We call it the "519" increase. In this period the internet-related stocks increased too quickly. The Shanghai index increased by 57% within 30 exchange days. However, on September 22, 1999, the government announced a new policy "The decision about reform and development questions of nationalized business", which was followed by an adjustment on the market. The Shanghai index decreased again till the end of year. After this adjustment the index increased quickly from the year 2000 and reached a maximum of 2242 in this period on June 13, 2001.

3.1.3. 2001 Q2 to 2005 Q2

During this period the stock index fluctuated with a downward trend. The index turned round after June 14, 2001 and decreased quickly. The 4-year bear market began from this date. The reason is the government's new policy to reduce the proportion of state-held shares. On October 23, 2001 the CSRC (China Securities Regulatory Commission) interrupted this new policy suddenly and the market

responded immediately, namely, the Shanghai index increased 9.87% on that day. However, after this day the Shanghai index kept decreasing. On June 24, 2002 the state council shut down the policy about reduction of the state-held shares and promises the government don't make new specific policy about reduction of state-held shares. Because of this good news, the Shanghai index increased by 9.3%. After the vibration on the high level within some days the Shanghai index decreased again, and the index decreased to 1013 in June, 2005.

3.1.4. 2005 Q3 to 2007 Q4

Figure 1 shows that the Shanghai index increased steadily over this period. The market value of Shanghai and Shenzhen Stock Exchange was more than 3 trillion RMB Yuan and took 16% of the GDP in 2005. In the year 2006 the Chinese stock price increased to an amazing high level. The Shanghai index increased by more than 126% in this year. The market recovered all previous losses following a five-year decline, and the Shanghai index reached 2675 points. From January to May 2007, a huge volume of external capital came into the Chinese stock market, which enabled the Shanghai index to break through 3000 and 4000 points. In May 30, 2007, the ministry of finance raised the stock transaction cost from 1‰ to 3‰. The following adjustment period in the market lasted two months. From July 20, 2007, the market increased again. At this time, the blue-chip stock got more investment and led index to a high level. Within nine exchange days the Shanghai index increased more than 15% and reached the highest point 6092.

3.1.5. 2007 Q4 to 2008 Q3

Figure 1 shows that the Shanghai index was going downward. After October 16, 2007, on which day the index reached the highest point, the index began to turn round and almost all shares include blue-chip shares' price went down. The stock market

bubbles from the blue-chip stock made investors worry. On November 27, 2007 the Shanghai index broke below the half year average line and in this quarter the Shanghai index decreased more than 21%. On January 16, 2008 the Chinese central bank announced that the required reserve rate will increase 0.5% and this announcement made market worse. On April 24, 2004 the ministry of finance decreased the stock transaction cost from 3‰ to 1‰ back again and the index increased 9.3% at the same day. However, with the onset of the global financial crisis the investors' expectations of future returns deteriorated, and the securities market reflected this situation clearly. At the end of 2008, the Shanghai index was at 1820.81, and it had decreased 65% within one year. In 2008 the Shanghai index reached highest point 5497 and lowest point 1706. The vibration extent was more than 222%. The total market value of Shanghai stock exchange was 9725 billion Yuan and the circulation market value was 3230 billion Yuan, they decreased by 64% and 50% relative to the previous year respectively.

3.1.6. 2008 Q4 to 2010 Q4

Since the last quarter of the year 2008 the Shanghai index began to increase. This increasing trend was kept during the year 2009. There were some fluctuations, but increase was the main trend. The reason was that the government took a proactive fiscal policy. The state council made the decision to do the infrastructure with four trillion RMB Yuan. This was the best news to the market and the market responded very well. From January 5, 2009 to February 17, 2009 the stocks of financial corporations and coal, in the Shanghai index, increased by more than 17%, and some shares even increased by more than 170% within one and a half month. After a short adjustment the Shanghai index again increased from March 3, 2009. This increase kept till August 4, 2009 and the Shanghai index increased more than 65%. In this

time the stocks about new energy were bellwether. In the last quarter of 2009, the Shanghai index decreased because the Shanghai stock exchange had second board. This part attracted more capital in this period. In 2010 the total trend of Shanghai index was decreasing, especially, since April 16, 2010 the stock index futures appeared in China, and investors had a new investment method to get profit. In the third quarter the index reached the bottom line and then increased a little.

3.2. Change of the money supply and market response

Figure 2: Change ofM1 (100 Million RMB)

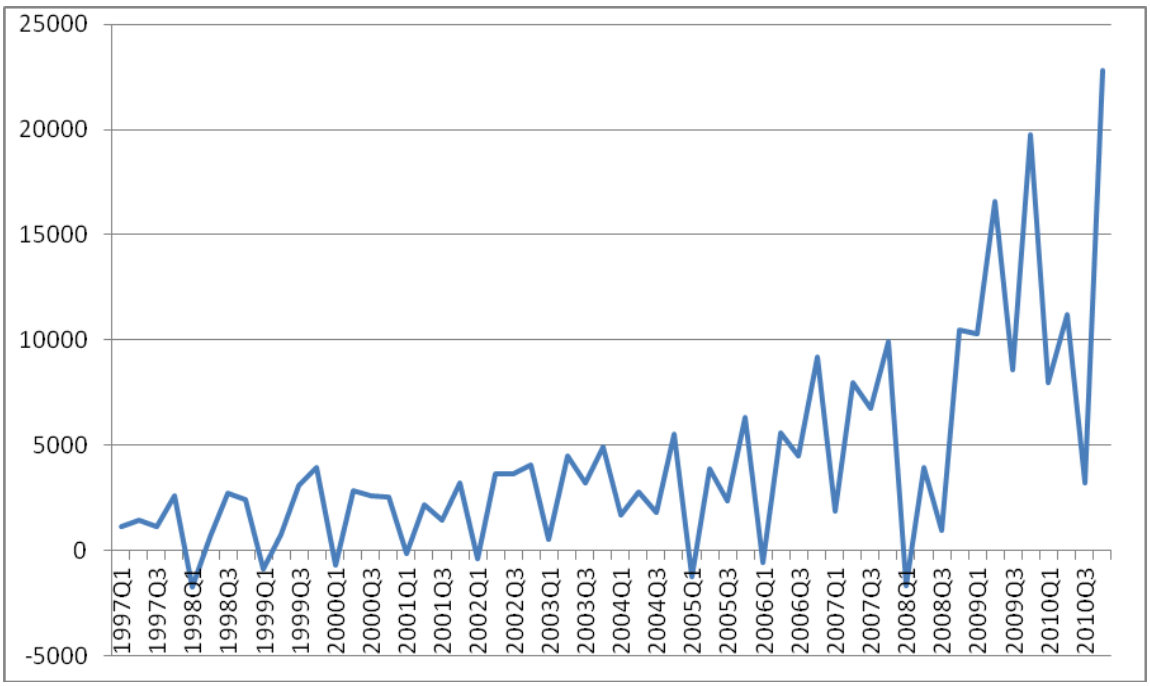

Figure 2 shows that M1 has increased most of the time, according to the statistical data from the National Bureau of Statistics of China. From this point of view we find that the relationship between money supply and stock index is unstable. In reality, we found that since second half year in 2001 the stock price decreased continually and money supply increased. The investors had negative expectation of the future stock

return and took the capital from the stock market. In 2006, the central bank followed a tight monetary policy and increased the interest rate three times. In 2007, the central bank even increased the interest rate six times to control the money supply. However, there was almost no effect on the stock market. The Shanghai index increased very fast. Since July 2007 the central bank moderately eased its monetary policy to help the stock market, but it could not keep the index from continuing its decrease. The stock price was moving in the opposite direction of the money supply.

3.3. Previous adjustment of interest rate and response of the market.

Table 1: Changes of the Interest Rate and Return on the Shanghai Index

Nr.	date	Interest rate after adjustment (%)	Change (%)	Market performance
1	Oct 23, 1997	5.67	-1.80	−0.35%
2	Mar 25, 1998	5.22	-0.45	−0.21%
3	July 01, 1998	4.77	-0.45	−1.70%
4	Dec 07, 1998	3.78	-0.99	−0.79%
5	June 10, 1999	2.25	-1.53	1.17%
6	Feb 21, 2002	1.98	-0.27	1.57%
7	Oct 29, 2004	2.25	0.27	−1.58%
8	Aug 19, 2006	2.52	0.27	0.16%
9	Mar 18, 2007	2.79	0.27	2.87%
10	May 19, 2007	3.06	0.27	1.04%
11	July 20, 2007	3.33	0.27	3.73%
12	Aug 22, 2007	3.6	0.27	0.50%
13	Sep 16, 2007	3.87	0.27	2.06%
14	Dec 20, 2007	4.14	0.27	2.06%
15	Oct 09, 2008	3.87	-0.27	-0.84%
16	Oct 30, 2008	3.6	-0.27	2.55%
17	Nov 26, 2008	2.52	-1.08	0.49%
18	Dec 22, 2008	2.25	-0.27	-1.52%
19	Oct 20, 2010	2.50	0.25	0.07%
20	Dec 26, 2010	2.75	0.25	-1.90%

The adjustment of interest rate is one of the most important financial policies for the government to control the financial market,[5] and it is also the important signal for the investors to know what the government will do on financial market in the next phase. Based on our analysis in part 2.1, we hypothesize that there is a negative relationship between interest rate and stock prices. In other words, when the interest rate increase the stock price will go down and vice versa. In our sample, the interest rate changed around 20 times: 10 increases and 10 decreases. However, the market reaction did not correspond to our assumptions. Sometimes the increase of the interest rate cannot stop the stock price to increase continually. At other times, both the interest rate and the stock prices decrease. The stock index wasn't moving in the opposite direction of the level of interest rate dramatically as we have hypothesized in Section 2. The market performance in table 1 is the change of the Shanghai index in first exchange date after adjustment of the interest rate.

Table 1 shows that on October 23, 1997 the interest rate decreased by 1.8 percentage points, and the Shanghai index decreased by 0.35%. After that the Shanghai index increased a little but the response was unclear. The first 4 decreases of the interest rate did not induce the hypothesized effect. On June 10, 1999 the index was moving in the opposite direction of the change of the interest rate at first time. On February 21, 2002 the interest rate decreased again and this interest rate (1.98%) was the lowest point since the stock exchange appeared in China. Then the index increased after an adjustment and this index increase kept in short period. On October 29, 2004 the interest rate increased by 0.27 percentage points to 2.25% and then the Shanghai index was going down continually. The lowest point of index was 1013.64. From

[5] There is a different point to OECD countries. The Chinese central bank is under the lead of state council of China. The central bank submit a report about monetary policy to state council and after the agreement of state council, then the central bank can do this monetary policy.

2006 to 2007 there was a big bull market in China. The central bank increased interest rate seven times in this period totally. While the interest rate increased from 2.25% to 4.14%, the Shanghai index increased also from 1180 to 6092 simultaneously. In the year 2007 the Shanghai index began at 2715 on January 04, 2007 and ended at 5261 on December 28, 2007. The index increased by more than 93%. To control the speed of this expansion, the central bank tightened monetary policy, they increased the interest rate six times in one year and increased the required reserve rate from 9% to 14.5% in ten times. However, there was no visible effect on the stock market. Then, the global financial crisis brought a negative effect on the Chinese stock market. Since the end of 2007, the Chinese stock market began to decrease. For this situation the central bank adopted a flexible monetary policy. On October 09, 2008 the central bank decreased the interest rate by 0.27 percentage points to 3.87%. But the Shanghai index decreased 0.84% on first exchange day and continued to decrease. On October 30, 2008 and November 26, 2008 the central bank decreased the interest rate by 0.27 and 1.08 percentage points respectively. These two decreases made the Shanghai index increase by 2.55% and 0.49%. On December 22, 2008, the interest rate decreased, and the Shanghai index decreased also. In the following year, the Shanghai index showed a rising trend. On October 20, 2010 the index increased with the increasing interest rate, whereas the index trend began to decrease from second exchange day. On December 26, 2010 the interest rate increased and the index decreased.

From this analysis we found there is no negative correlation between movements in the index and interest rate. We cannot find a clear relationship between the two variables. We will use econometric methods to model the dynamic interaction between the two variables in the next section.

3.4. Summary of this Chapter

This chapter has analyzed the relationship between stock index and other macroeconomic variables by descriptive statistics. By the real world data we also analyze the trend of the stock index. We describe the three relationships and the different effects on stock market. In the following, we will analyze these three relationships by econometric methods.

4. Empirical Analysis

4.1. Introduction of Method and Model

Time series analysis is a field of statistics. It investigates sequences of observations on a variable that have been measured at recurring time points. The typical macroeconomic variables are short and come in annual, quarterly, or monthly measurement. Time series analysis also plays an important role in finance. The main difference is that the financial time series have high frequency, like daily and big sample size. In the 1970s and 1980s, the economists made a big progress on the research of cointegration between variables. Granger and Newbold (1974) point out that when the time series is non-stationary and still we use the traditional regression method, we may have the spurious regression problem, namely, we will have a high value of R^2 and t-values are also significant, but we actually have invalid results that do not make sense in economic terms.

4.1.1. Stationarity

Before doing the cointegration tests, we should first check whether the time series we will test are stationary. We call a time series stationary when this time series have a time-distance-dependent covariance structure and time-constant mean and variance. We can test the stationarity by using the unit root test. If there is a unit root, the time series is non-stationary, otherwise, if there is no unit root we say this time series is stationary. According to Engle and Granger (1987), a series is said to be integrated of order *d*, in symbols I(*d*), if there is no deterministic component and it has a stationary, invertible ARMA representation after differencing *d* times. A unit root test tests the stationarity of a time series using an autoregressive model. A well-known test that is

valid in large samples is the augmented Dickey–Fuller test (ADF) with the null hypothesis of unit root.[6] The estimated model is as follows:

$$\Delta X_t = \alpha + \beta t + \gamma X_{t-1} + \sum_{j=1}^{p-1} \delta_j \Delta X_{t-j} + \varepsilon_t,$$

where α is a constant, β the coefficient on a time trend and p the lag order of the autoregressive process, which is usually determined by an information criterion, such as Akaike information criterion (AIC), Bayesian information criteria by Schwarz (SBIC) etc. Then calculate the t-statistics of γ, and compare it to special tables of significance points. The intercept α and trend βt are optional according to specific case.

4.1.2. Vector Autoregression (VAR)

A vector autoregression (VAR) is an econometric model used to capture the evolution and the interdependencies between multiple time series, distinguished from a univariate autoregression by the fact that single variables are replaced by vectors of variables and all coefficients are replaced by coefficient matrices. All the variables in a VAR are treated symmetrically by including for each variable an equation explaining its evolution based on its own lags and the lags of all the other variables in the model. A VAR is defined by the equation

$$X_t = \mu + \sum_{j=1}^{p} \Phi_j X_{t-j} + \varepsilon_t,$$

where X is now a vector of variables, μ is a vector of constants, ε is a vector of unobserved white-noise errors and $\Phi_j, j = 1, \ldots, p$ are matrices of coefficients with

[6] Engle, R. F. & Granger, C. W. J. Cointegration and Error correction representation. Estimation and testing. Econometrica. 1987, 55, 250-276

dimension of $n \times n$, where n is the number of components in *X*. The two most important problems in practice are lag-order determination and estimation. The first problem can be usually solved by minimizing AIC or SBIC, as the number of coefficient parameters is very large in VAR system, according to the definition of those information criterion, these techniques usually find short lag lengths, say, 1 or 2. The estimation of VAR is mostly implemented by ordinary least squares.

4.1.3. Cointegration Test

The concept of cointegration was developed by Engle and Granger, who explored long-run relationships among variables. In general, they defined two d-order integrated variables are cointegrated if there is a linear combination of them that is integrated of order (d-b), said them cointegrated of order (d, b), denoted as CI(d,b).

One can easily write the vector autoregression equation into error correction form as

$$\Delta X_t = \mu + \Pi X_{t-1} + \sum_{j=1}^{p-1} \Pi_j \Delta X_{t-j} + \varepsilon_t,$$

With the new matrix coefficients $\Pi, \Pi_1, \dots, \Pi_{p-1}$ related to the old ones, $\Phi_1, \dots, \Phi_p$ by a straight forward one-one mapping. And $rk\,\Pi$ yields the number of independent cointegrating vectors. If $rk\Pi = 0$, there is no cointegration, meaning there are no long-run equilibrium relationship among components of X; if $rk\,\Pi = 1$, there is exactly one cointegration; if $1 < rk\Pi < n$, the number of equilibriums is unique but the relationships themselves are not, so analytical work is necessary to determine the relationships of interest; if $rk\Pi = n$, the VAR is stationary.

4.1.4. Granger Causality Test

The Nobel Prize laureate Clive Granger introduced the Granger causality test to determine whether one time series is useful in forecasting another. A time series *X* is

said to Granger-cause *Y* if it can be shown, usually through a series of t-tests and F-tests on lagged values of *X* (and with lagged values of *Y* also included), that those *X* values provide information about future values of *Y*.

4.1.5. Impulse Response Function

In economics, impulse response functions describe how the economy reacts over time to exogenous impulses, which economists usually call "shocks", and are often modeled in the context of a vector autoregression.

If a VAR is stable, it can be transformed to a moving average representation

$$X_t = \mu^* + \varepsilon_t + \Theta_1 \varepsilon_{t-1} + \Theta_l \varepsilon_{t-2} + \cdots,$$

where the *(j, k)* entry of Θ_l can be explained as the marginal reaction of $X^{(j)}$ to a unit shock in $\varepsilon^{(k)}$ that happened *l* time periods before.

4.2. Data Analysis

4.2.1. Variable Selection

The stock index is an important index for the stock market; it reflects the prices of stocks immediately. In the Chinese stock market there are many different indexes, we choose the Shanghai composite index as our research object. There are two reasons: first, the Shanghai composite index can reflect the performances of stocks in all different fields, so this index has close connection to the performance of macro economy. Second, the Shanghai securities exchange and Shenzhen securities exchange have similar policy, investor structure. Many researchers also point out that movements in the two indexes are similar.[7] Because there are more state-owned listed

[7] Yang Huimin. The relationship between stock price index and macroeconomy in China. (2009)

companies at Shanghai and those businesses are more important for the Chinese macro economy, we use the Shanghai composite index as our object.

Based on our objective and the above introduction, we will use Gross Domestic Product (GDP) as the index of Chinese macro economy. This index reflects the total performance of the Chinese economy.

The interest rate we use herein the one-year term deposit rate. The central bank will set the one-year benchmark deposit and lending interest rate first when it plans to change the interest rate. At the same time the deposit rate has more influence than the lending rate in China, and the one-year term deposit rate has the greatest impact.

The money supply is the total amount of money available in an economy at a particular point of time. Based on the international norm and real situation in China, the Chinese central bank reports three currency concepts:

M0 = currency in circulation

Narrow currency M1 = M0 + demand deposits of institutions

Broad currency M2 = M1 + term deposits of institutions + resident bank savings deposit + customer margin of securities company + other deposits

The M1 is the most important phase which the central bank controls. And many papers mention that the M1 has the greatest impact for Chinese stock market, which means that most investors are small investors in China. The capital which they invest is normally the cash and saving deposit. That is why we take M1 as our test variable of money supply.

4.2.2. Data Processing

We use the method of VECM to model the relationship between the macro economy and the stock index. The sample runs from the first quarter in 1997 to the fourth quarter in 2010. We have two reasons to take our sample from the first quarter in the year 1997: first, the Chinese stock market has short history. If we use annual data instead of quarterly data then our sample size will be too small to permit statistical inference; second, to avoid overinvestment and keep market stability the CSRC implemented two policies which are "T+1 Trading" and "limit of price increase and decrease" on the Chinese stock market at the end of 1996. After that the Chinese capital market developed in all-around way. Zhang (2004) points out that the Chinese stock market grows up to its maturity. The stock market increases more and more, and it starts working according to usual standards. So we pick up the data from this time period and we think the research result should be more reliable with this data. That will help us to understand the relationship between the Chinese stock market index and the macro economy.

We use the quarterly average number of the Shanghai stock index, namely, we add all index number in one quarter and then divide by the number of exchange days in this quarter.[8] We found all Shanghai indexes from the Website of "Sohu Financial".

Because the GDP is a flow variable, we calculate the quarterly GDP growth rate as the difference between the (logarithm of the) GDP in the current quarter and the (logarithm of the) GDP in the previous quarter. Data are taken from the National Bureau of Statistics of China.

[8] Some papers only use the index at first exchange date and last date in a quarter. They add the two numbers and divided by 2. (e.g. Yang(2009)) I think it may lose some information.

The one-year term deposit rate we calculate by the weighted average method. For example, if there are two changes in the last quarter of 2010(Oct 20, 2010 and Dec 27, 2010). Then, we calculate the weighted average interest rate like this: 2.25*19/92+2.5*67/92+2.75*6/92=2.46. The original data are from the website of Industrial and Commercial bank of China Limited.

M1 is a stock variable. We also calculate the difference between the two logarithms of consecutive quarters to get quarterly M1 growth rates. In symbols: $DLM1_t$= log $M1_t$ – log $M1_{t-1}$. Data for M1 stem from the People's Bank of China (the Chinese central bank).

4.3. Test

We report on the econometric tests in this section. First, we apply some adjustments to the variables that are needed for our tests. Second, we apply unit root tests to all variables and determine whether they are stationary or integrated. Third, if all variables can be used to do the cointegration test then we will perform this test and get the cointegration equation for the stock index and macroeconomic variables. Fourth, when there is a cointegration relationship between stock index and macroeconomic variables then we will do the Granger causality test to know whether the macroeconomic variables are the direct reasons for the change of stock index. At the end we will do the impulse response analysis to examine how the macroeconomic variables affect the stock index and at what lag.

4.3.1. Adjustments of Variables

Figure 3: Quarterly GDP

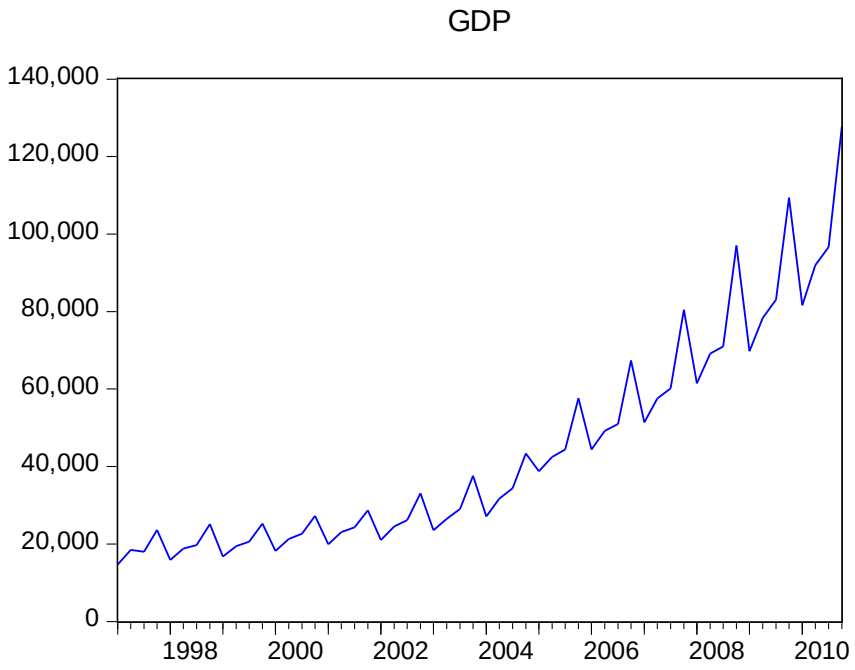

Figure 4: Quarterly nominal GDP after adjustment

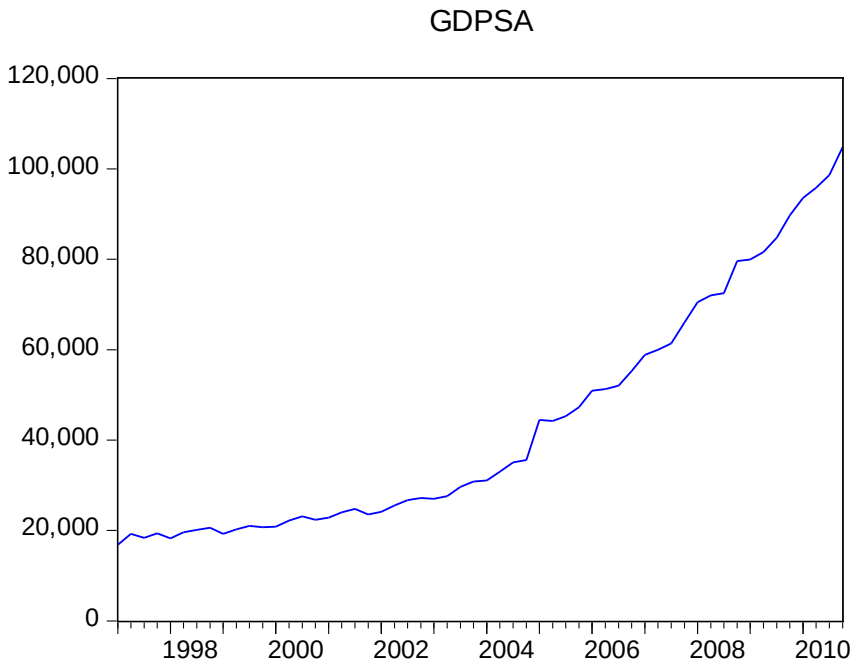

Figure 3 demonstrates clearly that there is seasonality in quarterly Chinese GDP. If there is seasonality in a time series it might bring some problems for our test result. For that reason we have adjusted the GDP data to delete seasonal effects as a preliminary step. In this paper we use the "ratio to moving average – multiplicative" method for seasonal adjustment.

Figure 4 confirms that there is no visible seasonality any more. The other variables do not provide evidence on seasonality, so they do not need any adjustment. We still need to do the logarithmic processing on the variables because we want to make the series smoother and to eliminate heteroscedasticity. All calculations were done using Eviews6.0.

4.3.2. Unit Root Tests

At first we check whether variables are stationary or first-order integrated, as the latter property is often seen as a precondition for cointegration tests. We apply the ADF test to test the stationarity of each variable.

Table 2: Augmented Dickey-Fuller test

Variables	Constant	Trend	p-value	Stationarity
LINDEX	c	t	0.1048	no
D_LINDEX	-	-	0.0000	yes
LGDP	c	t	0.7383	no
D_LGDP	c	-	0.0000	yes
LM1	c	t	1.0000	no
D_LM1	-	-	1.0000	no
D_DLM1	-	-	0.0000	yes
LR	c	-	0.0646	no
D_LR	c	-	0.0000	yes

L denotes logarithms of the initial variables and D_ denotes the first differences.

Table 2shows the p-value of every time series and first difference of each series. The null hypothesis here is “time series has a unit root”. We find that the p-values of time series of index, GDP and M1 are greater than 10%, so the null hypothesis is accepted at significance level of 10%. Hence, the index, GDP, and M1 are non-stationary. The interest rate is also non-stationary at a significance level of 5%. However, the first difference of each series (except M1) is stationary with p-value zero. The money supply M1 is I(2), its second difference is stationary. Hence, the first differences of this variable are to be used in a joint model with other I(1) variables.

4.3.3. Johansen Cointegration Test

Based on the result from the unit root test we can do the cointegration test now.

Table 3: Cointegration Test Result
Unrestricted Cointegration Rank Test (Trace)

Hypothesized No. of CE(s)	Eigenvalue	Trace Statistic	0.05 Critical Value	Prob.**
None *	0.656398	89.25249	47.85613	0.0000
At most 1 *	0.286777	32.63411	29.79707	0.0230
At most 2	0.230909	14.72215	15.49471	0.0651
At most 3	0.015115	0.807233	3.841466	0.3689

Trace test indicates 2 cointegrating eqn(s) at the 0.05 level
* denotes rejection of the hypothesis at the 0.05 level
**MacKinnon-Haug-Michelis (1999) p-values

The results in Table 3 suggest that there are two cointegrating equations between the Shanghai index and GDP, money supply and interest rate at a significance level of 5%. Based on this information we will continue to do the VECM and to find the relationship between those variables in long and short term.

4.3.4. VEC Model

We use it to check the dynamic relations between macroeconomic variables and the stock index in China. The following table shows us the result of VEC model:

Table 4: Vector Error Correction Estimates

Date: 12/11/11 Time: 22:09
Sample (adjusted): 1997Q4 2010Q4
Included observations: 53 after adjustments
Standard errors in ( ) & t-statistics in [ ]

Cointegrating Eq:	CointEq1	CointEq2
LINDEX(-1)	1.000000	0.000000
LGDPSA(-1)	0.000000	1.000000
DLM1(-1)	-66.98374	-74.29705
	(7.85000)	(9.71980)
	[-8.53296]	[-7.64389]
LR(-1)	-0.454585	-1.556785
	(0.34137)	(0.42269)
	[-1.33163]	[-3.68306]
C	-4.467410	-6.126691

Error Correction:	D(LINDEX)	D(LGDPSA)	D(DLM1)	D(LR)
CointEq1	-0.101508	-0.013464	0.021730	-0.079169
	(0.03396)	(0.01246)	(0.00808)	(0.03210)
	[-2.98909]	[-1.08069]	[2.68975]	[-2.46670]
CointEq2	0.073151	0.020721	0.012326	0.063046
	(0.02934)	(0.01077)	(0.00698)	(0.02773)
	[2.49280]	[1.92462]	[1.76570]	[2.27325]
D(LINDEX(-1))	0.520762	0.015135	0.056010	0.191388
	(0.13687)	(0.05021)	(0.03256)	(0.12935)
	[3.80482]	[0.30142]	[1.72021]	[1.47956]
D(LINDEX(-2))	0.057817	-0.005667	0.056984	0.269412
	(0.15858)	(0.05818)	(0.03773)	(0.14988)
	[0.36458]	[-0.09739]	[1.51047]	[1.79755]
D(LGDPSA(-1))	-0.564992	-0.390703	-0.031293	0.215079
	(0.41845)	(0.15352)	(0.09955)	(0.39548)
	[-1.35020]	[-2.54493]	[-0.31436]	[0.54385]
D(LGDPSA(-2))	-0.347423	-0.201288	-0.020616	0.452996
	(0.38336)	(0.14065)	(0.09120)	(0.36232)
	[-0.90625]	[-1.43114]	[-0.22606]	[1.25028]
D(DLM1(-1))	-1.300796	0.420483	0.797439	-0.557604
	(0.90449)	(0.33184)	(0.21517)	(0.85483)
	[-1.43816]	[1.26713]	[3.70610]	[-0.65230]
D(DLM1(-2))	-0.724668	0.088616	0.438731	-0.244099
	(0.54658)	(0.20053)	(0.13003)	(0.51657)
	[-1.32583]	[0.44191]	[3.37418]	[-0.47254]
D(LR(-1))	-0.163981	0.116577	-0.073131	-0.033235
	(0.14869)	(0.05455)	(0.03537)	(0.14052)
	[-1.10287]	[2.13708]	[-2.06755]	[-0.23651]
D(LR(-2))	-0.215883	0.044504	-0.065083	0.137451

	(0.15247)	(0.05594)	(0.03627)	(0.14410)
	[-1.41590]	[0.79560]	[-1.79435]	[0.95386]
C	0.028953	0.055341	-0.001838	-0.047881
	(0.02673)	(0.00981)	(0.00636)	(0.02526)
	[1.08304]	[5.64259]	[-0.28898]	[-1.89516]
R-squared	0.495040	0.290664	0.782352	0.377581
Adj. R-squared	0.374811	0.121774	0.730531	0.229386
Sum sq. resids	0.507357	0.068291	0.028712	0.453176
S.E. equation	0.109909	0.040323	0.026146	0.103875
F-statistic	4.117484	1.721026	15.09721	2.547870
Log likelihood	47.99030	101.1343	124.0953	50.98305
Akaike AIC	-1.395860	-3.401294	-4.267747	-1.508794
Schwarz SC	-0.986932	-2.992365	-3.858818	-1.099866
Mean dependent	0.017166	0.032882	0.000989	-0.020957
S.D. dependent	0.139004	0.043028	0.050368	0.118329
Determinant resid covariance (dof adj.)		1.28E-10		
Determinant resid covariance		5.05E-11		
Log likelihood		327.4966		
Akaike information criterion		-10.39610		
Schwarz criterion		-8.462983		

Table 4 shows that both GDP lagged one period and GDP lagged two periods affect the stock index negatively, but the t-statistic is not significant.[9] This means that GDP has weak influence on stock index in short period. However, we found that all macro variables affect the stock index negatively and that their t-statistics are not significant.

The first part of Table 3 yields the following two equations:

$$\varepsilon = LINDEX - 67.98LDLM1 - 0.45LR - 4.47 \quad (1)$$

$$\varepsilon = LGDP - 74.30DLM1 - 1.56LR - 6.13 \quad (2)$$

Subtracting equation (2) from equation (1) and solving for LINDEX yields

$$LINDEX = LGDP - 7.32DLM - 1.11LR - 1.66 \quad (3)$$

Equation 3 implies that the Shanghai index responds positively to GDP in the long run, and that, when the GDP increases one unit, the Shanghai index will increase also one unit. This change corresponds to our theory. The Shanghai index reacts negatively to M1 and to the interest rate. When both M1 and interest rate increase one

[9] The t-statistics is not significant when the t-value is between [-1.95, +1.95]

unit, the Shanghai index decreases 7.32 and 1.11 units respectively. The change of R corresponds to the theoretical part we discussed before, but M1 does not. In Section 1.2.2 we say that the relationship between stock index and M1 should be positive, but our test result does not correspond. We will analyze later.

The first two rows in the second part of Table 3 show that the t-statistics for LINDEX, LR and LM1 (but only first one) are significant. This means those variables can make the whole system get back to the equilibrium when there is a deviation of the equilibrium in the system.

4.3.5. Granger Causality Test

Now we know that there is a cointegration relationship between the Shanghai index and our macroeconomic variables. So we perform the Granger causality test in levels. The test results are given in Table 5.

Table 5: Results of the Granger causality test

Pairwise Granger Causality Tests
Date: 04/22/11 Time: 14:51
Sample: 1997Q1 2010Q4
Lags: 2

Null Hypothesis:	Obs	F-Statistic	Prob.
LGDPSA does not Granger Cause LINDEX	54	6.37049	0.0035
LINDEX does not Granger Cause LGDPSA		0.21619	0.8063
DLM1 does not Granger Cause LINDEX	54	0.59748	0.5542
LINDEX does not Granger Cause DLM1		2.75442	0.0735
LR does not Granger Cause LINDEX	54	1.52555	0.2277
LINDEX does not Granger Cause LR		4.58313	0.0150
DLM1 does not Granger Cause LGDPSA	54	1.83092	0.1711
LGDPSA does not Granger Cause DLM1		1.30113	0.2815
LR does not Granger Cause LGDPSA	54	2.16928	0.1251
LGDPSA does not Granger Cause LR		0.83645	0.4393
LR does not Granger Cause DLM1	54	1.32534	0.2751
DLM1 does not Granger Cause LR		1.37216	0.2631

Table 5 shows that the null hypothesis “LGDPSA does not Granger cause the LINDEX” has the p-value 0.0035. This means that we reject the null hypothesis and that GDP Granger-causes the Shanghai index. By contrast, the Shanghai index does not Granger-cause GDP. The null hypothesis “M1 does not Granger-cause the index” yields a p-value of 0.55. So we should accept the null hypothesis, namely, the change of M1 is not the direct reason for the change of index. But with significance level 10% the index Granger-causes M1, namely, the change of Shanghai index could be one reason for the change of M1. The interest rate does not Granger-cause the Shanghai index, as the p-value is 0.23. However, the p-value for null hypothesis “index does not Granger-cause the interest rate” is lower than 5%. In summary, the change of interest rate is not the direct reason for a change of the Shanghai index, but the change of Shanghai index is a reason for the change of the interest rate.

We can summarize like this: the GDP is one of the reasons for the change of stock index, and the stock index is not the direct reason for the change of GDP; the money supply and interest rate are not the direct reason for the change of stock index, but the stock index could be one of the reasons for the change of the money supply and interest rate.

This result may differ from some existing researches (Men and Li, 2006), as we use the latest economic data and we also use data transformed by logarithms instead of absolute real numbers.

4.3.6. Impulse Response Analysis

We focus on the relationship between the change of stock index and the change of macroeconomic variables. In this part we use the impulse response to observe how the change of macroeconomic variables affects the stock index.

Figure 5: impulse response of Shanghai index to GDP, interest rate and M1

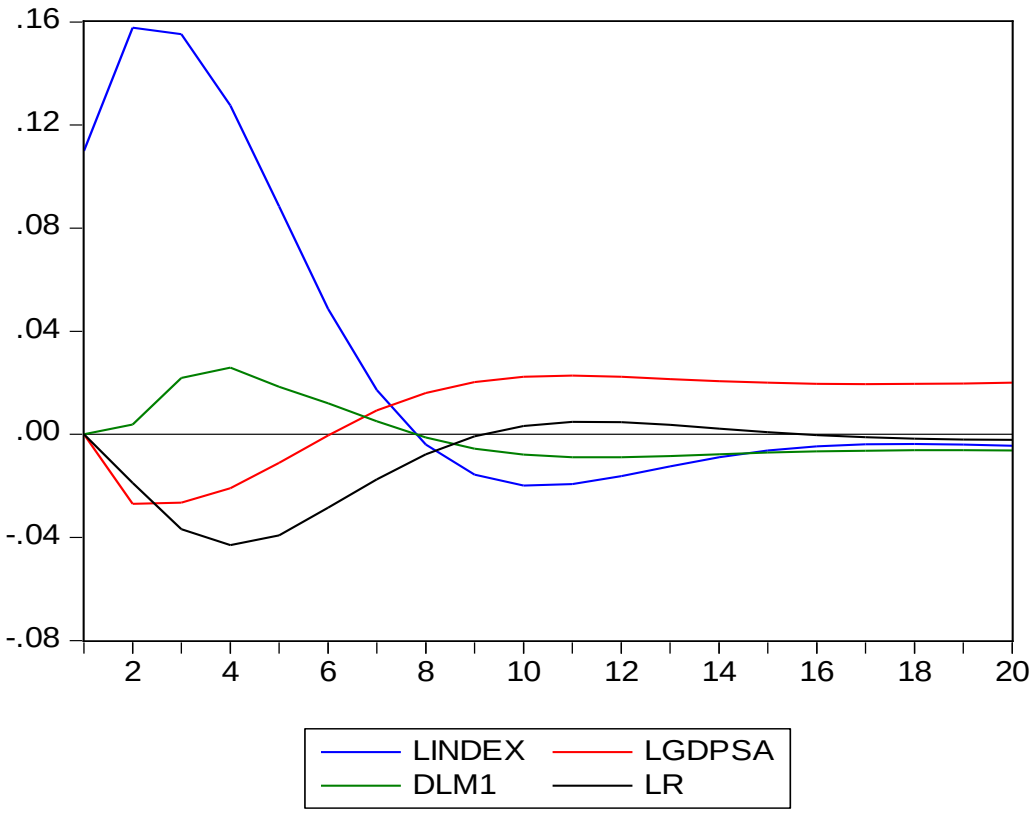

Figure 5 shows that the Shanghai index reacts to its own shocks rapidly. It increases by about 0.11 standard deviations. In the second period the value is almost 0.16. After this, it begins to decrease, and the reaction becomes weaker. At eighth period it comes back to the original level and after that the reaction is negative. In the period 10 the negative reaction shows clearly, the value is -0.02, and the reaction turns to weaker again. After period 16 the reaction value is close to the original level.

A unit GDP shock can lead to an about 0.03 decrease of the Shanghai index but this effect tends to be stable at the level of 0.02, which means that a positive effect from GDP to stock market begins after 1.5 years.

The Shanghai index has a positive reaction to the innovation in money supply at beginning. Then it tends to be negative for a short period, after period 10 the reaction

remains constant at about 0.01. We also found the money supply has mostly little negative effect for the Shanghai index. This does not correspond to the theory outlined in Section 2.

The influence of interest rate on the stock market index is negative at first and reaches the maximum 4 periods after the shock, while the effect turns to be positive later and then vanishes. That means, the period from the adjustment of the interest rate to the maximum impact on the stock market is one year.

In short and middle term, the interest rate affects the index strongly. In the long term, the interest rate and money supply have almost no effect to the stock index.

4.4. Result Analysis

4.4.1. Result

Based on theoretical analysis and empirical evidence, and considering the Chinese economic real circumstances, we choose the typical index, which is the Shanghai composite index, and take the main macroeconomic variables which are money supply, interest rate and GDP, and we use these data to find the correlation between the stock index and the macro-economy in China. We have done the unit root test, cointegration test, error-correction VAR model, Granger causality and impulse response analysis. The results can be summarized as following:

a) Through the unit root test we found that the four series log (Shang index), log (GDP), log (M1) and log (interest rate) are non-stationary at the 1% significance level. The logarithmic differences of three variables (index, GDP and interest rate) are

stationary at the 1% significance level.[10] This result says that we have already enough preconditions to do the cointegration test.

b) The result of the cointegration test supports two cointegrating equations.

c) The result of error-correction VAR model shows that the Shanghai index is related positively to GDP, and negatively to M1 and to interest in long term. All macro variables affect the stock index negatively in the short run, but the t-statistic is not significant. The variables LINDEX and LR can more effectively take the whole system back to the equilibrium.

d) The Granger causality test says that the GDP is one of the reasons for change of Shanghai index and Shanghai index is not the reason to cause the change of GDP. The M1 and interest rate are not the direct reason to cause the change of the Shanghai index, but the Shanghai index can be one of the reasons for the change of the M1 and interest rate.

5) By impulse response analysis we found that the macro economic variables like GDP, money supply and interest rate can affect the stock price in the future. But the most important influence factor for the change of the stock price in the future is the market itself. According to our result the impact level of macroeconomic variables, in descending order, are GDP, interest rate and money supply. At the beginning the impact of GDP and interest rate to the Shanghai index is negative. Then the impact of GDP to Shanghai index becomes positive and levels out. The impact of the interest rate on the Shanghai index is very weak.

[10] The M1 is I(2), we use the DLM1 in this thesis.

The main point of our empirical research is: there is a long run equilibrium relationship between the Shanghai index and macroeconomic variables. In short term the Shanghai index moves to the opposite direction of GDP, but there is a positive relation between GDP and Shanghai index in long term. GDP is one of the causes for the change of Shanghai index, but not in opposite direction. The money supply and interest rate are negatively related to the Shanghai index, and neither money supply nor interest rate is a reason for change of Shanghai index. But the Shanghai index is one of the causes for the change of money supply and interest rate.

4.4.2. Explanation

In this part we will make the explanation to our empirical evidence. We will explain three variables impact to the stock index respectively.

a) The empirical results show that the stock index and macroeconomic variables are cointegrated in China. The stock price index moves in opposite direction of GDP in short term. But the stock price index is positively related to GDP in long term. This shows that the macro-economy is conducive to the good development of stock market in long term, but not in short run. This result confirms the findings of Liu (2006). Liu (2006) points out that there is a “short term paradox”, namely, the stronger the macro economy growth, the weaker the stock market may perform. And this influence factor cannot be ignored.

The Chinese macro economy is the fundamental for the Chinese stock market. According to the theoretical analysis, the development of real economy is the main reason for the development of the stock market. That is the reason that we found there is a positive relation between GDP and stock price index in long term. This finding is also consistent with our empirical findings. The development of the macro economy

can help the stock market to develop well. The better the macro economy develops the more liquidity the people have. Then, people can use this liquidity to invest into the stock market to obtain higher returns.[11] When the macro-economy develops well, this will improve agents' expectations for future returns on the stock market. Then they will invest more capital on the security market and this behavior will help to increase the stock price index. On the other hand, when the macro economy is weakening, investors have bad expectations for the future market. They will take the capital from the security market, and this action leads to a deterioration of the stock market conditions, in other words, the stock price index will decrease.

However, other factors (other fundamental factors and non-fundamental factors) have also effects on the stock price in the short run. If the negative impact factors are big enough to cancel out the positive effects from the macro-economy, such as a highly speculative market, fraud of the listed company, improper policy, bad expectations of the investors, issue problems of new stock, etc., all of this could be the reason that the stock price index has a negative relation with the macro-economy. The Chinese economy grows very quickly and that would be the chance to use to do some illegal action on the stock market. Especially, the Chinese stock market is still young and the regulation is not very good. The result of this bad action will be that investors will lose the confidence in the stock market. Although the macro economy is increasing very fast, the stock price may decrease, just like the bear market after July 2001.The reason was the inadequate policy for the stock market. Another piece of evidence is the stock performance during the financial crisis after October 2007. The Chinese

[11] Xia Enjun, Liu Nan, ShenJie. The Effect of Money Supply on Capital Market Return: Analysis on China Stock Market, Technology Economics. 2008(07), 81-84

GDP still increases, but the stock price already decreases. The Chinese GDP increased by 9% in the year 2008, but the Shanghai index decreased by 66%[12]. Here we can find the stock price index moves in opposite direction of the GDP in short term clearly. The reason is that investors have bad expectation for the future returns on the stock market because of inflation in China and the global financial crisis.

The other important result is that GDP is one of the reasons of change of stock price index, but not in opposite way. That shows that the stock market can reflect the performance of the macro economy in long term. The Chinese stock market cannot reflect the expectation of investors on macro economy. It does not play the role of a barometer of the economy. There is no strong effect from the stock market to the real economy. The reasons could be:

First, the structure of investors is not rational. There is a higher proportion of individual investors in the Chinese stock market. The institutional investors take only small proportion. By comparison, the large institutional investors take a higher proportion in the established stock market in the OECD countries. These institutional investors mainly are securities investment funds which are more professional and have large teams. They can find effective information more quickly than individual investors, and this information can help the institution to do profitable investment and to keep the stock market on the right way. Their investment plays an important role for the development of the stock market. It is also a good measure for whether the stock market works well. However, most investors are small and medium investors in the Chinese stock market. During the period January to March 2007, the individual investors who have a share value of less than one million RMB Yuan take a

[12]The index is 5261 on 28.12.2007 and 1820 on 31.12.2008

proportion of 98% of investors,[13] their share value amounts to 40% of the total market value of the Shanghai stock exchange. The analysis of investment behavior reveals that the individual investors, especially the small investors, like to hold and trade the small-cap stock, lower-price stock and high profit stock. The holding period is very short and they trade very frequently. For them, speculation appears to be the aim of the investment. Most of the small investors won't spend time to analyze the annual report of the listed company and take care of the macroeconomic data. It is very difficult for them to allocate their portfolios based on the firm's future earnings forecasts. The existing papers show that when there are fluctuations of the stock price or trading volume, the individual investors are more sensitive than institutional investors. The individual investors are short of the philosophy of long-term investment. At the same time, although institutional investors made a big progress in recent years in China, and they are becoming the main investors play an important role on the market, the investment volume of insurance fund and pension fund is still relative small in the stock market. Compared to the OECD countries, Chinese institutional investors have the same problem as Chinese individual investors, namely, they are also holding in short term and trade frequently. Moreover, all kinds of institutional investors have similar investment philosophy and investment targets. This is also not conducive for the long-term development of the Chinese stock market. A more serious problem is that some institutional investors manipulate the stock price through the inside trading, illegal operation, etc. This behavior makes the stock market more speculative, and then the stock market cannot accelerate the development of macro economy.

[13] YANG(2009)

Second, the listed companies cannot represent the total national economy very well. For now, most large enterprise groups put only a part of business or subsidiaries on the stock market. And some large companies are not listed or listed only in Chinese stock markets. That is the reason why the listed company in China cannot reflect the macro economy very well. Since the second half of 2006, the big companies which run the business in the field like bank, insurance, railway industry and so on issued IPOs in Chinese stock market.[14] This improved the structure of Chinese stock market. But the good blue chip shares are still too few on the Chinese stock market. With the reform and opening up, the Chinese economy develops rapidly. A large number of private enterprises grow very fast. Many of them have high innovative ability and high productivity. However, at present those private enterprises take lower proportion of Chinese listed company. Many industry-leading firms don't appear in the Chinese stock market. After the small and medium-sized enterprises (SMEs) board is established, this situation gets better. But overall, the current structure of listed companies still cannot fully reflect the development of the Chinese economy. Meanwhile, the listed companies in China should also improve their quality. Because of the policy and regulation, some listed companies have more problems, such as a direct influence on the management by big shareholders. The position for owner of some state-owned listed firms is in absence. "In absence" is a "special" Chinese word[15] in recent year in China. The owner of state-owned firms is the government, but under the Chinese law the government is not allowed to do the business. The government must find an agent to run the company. The agent for these state-owned listed firms didn't do their jobs properly, which is not conducive to the development of Chinese stock market.

[14] Yang(2009)

[15] I want to translate this Chinese word (缺位) into English but I cannot find an exact word here.

Third, the policy can affect the stock market. From the beginning the Chinese stock market is under the intervention of the Chinese government. The Chinese stock market has developed for close to 20 years, and it is already an important part of the national economy. But compared with the mature stock market in developed countries the Chinese stock market is still too young and has many problems. In the Chinese stock market system, the financial instrument is relatively weak and the government administration is too strong. The regulation department likes to use direct administrative interventions on the listed company, stock market and investors. The financial and legal method is not enough, and these two methods are used with lower frequency and also effectiveness. This direct intervention has considerable impact on the stock market, and every direct intervention causes some volatility on the stock market. This characteristic let the investors think that the government can control the stock market completely. In other words, when the stock price increases or decreases too fast the government must do some policy to keep the financial system stable. For example, on May 30, 2007 the government raised the trade tax; on April 24, 2008 the government decreased the trade tax; on September 19, 2008 the government made policy that the trade tax is collected only by share seller. These all are obviously direct administration intervention on the stock market. Under this situation the investors will lose the ability to determine the stock price. And the stock market also cannot reflect development of the real economy. The impact of the stock market on real economy is also not significant.

b) The empirical result shows that there is a negative correlation between stock price index and money supply, and it is not same as we analyze in this paper before. The possible reason may be:

First, the Chinese stock market is still young and not very standardized. The stock price can be affected by many economic variables and many other factors. Therefore, even if the money supply increases, and interest rate will fall, the investment volume increases, the stock return won't increase certainly.[16] The intrinsic stock value cannot show immediately, namely, the positive effect on stock price is difficult to see.

Second, the social security system is imperfect in China. For example, after October 2007 the central bank increased the money supply, but due to the global financial crisis and pessimistic future expectation on the stock market the investors decided to save the money in bank to avoid the possible risk on stock market. So in this situation the increasing money supply cannot help to increase the stock price index. In our empirical results we found a negative relation between the stock index and the money supply.

c) The empirical results show that the interest rate and the stock index are negatively related, which is consistent with our theoretical analysis. In short run if the central bank increases the interest rate, the stock price index will decrease at that day or in following days. But according to the above analysis we found that the stock price index move in same direction with interest rate sometimes. That means there have been changes in stock price before announcement.[17] The impact of change of interest rate is canceled, so the stock price index and interest rate will move in same direction in following days. In long term the impact of the change of interest rate will show in

[16] Sun Yunyu. Stock Price, Money Supply and Monetary Policy – The empirical Research basis on the Data from 2000 to 2007

[17] Tu Xiaomin. The Empirical Research of the Impact on Stock Market from Changes of Interest Rate. Journal of Southwest University for Nationalities, 2005(07)

the profit of firms. The profit will affect the stock price continuously. When the interest rate increases, the profit of firms will decrease, then the stock price will also decrease. That is the reason why there is a negative relation between stock price index and interest rate.

In addition, from the impulse response analysis we found that the interest rate and money supply affect the stock index price very lightly. And the effect of change of interest rate is weaker and shorter than change of money supply. But the central bank cannot easily control the money supply. The volume of money supply is also the ex post statistics. In comparison, the interest rate can be controlled easier. So the interest rate can be the best financial tool to use. In other words, if we want to cut the big volatility of the stock price we should choose the instrument of the interest rate, and this can also ensure that the macro-economy develop in a healthy way.

Neither the interest rate nor the money supply Granger-cause the change of stock price index. By contrast, the stock price index Granger-causes the change of interest rate (at 5% level) and money supply (at 10% level), which means the variation of interest rate and money supply is not the direct cause of fluctuation of the stock market. There are many non-monetary policies which can affect the changes of the stock price index. But the performance of the stock market is an important factor to be considered when assessing a new monetary policy. The Chinese stock market has two important features: “the price based on policy” and “the price based on capital”. The monetary policy includes the money supply and the cost of capital. That means the monetary policy can influence the supply-demand relationship for the capital in security market directly. So the Chinese central bank should pay more attention to the stock market.

5. Conclusion

In this paper we use econometric methods to investigate the relationship between Chinese stock market and macro economy. For the macroeconomic factors we choose the GDP, money supply and interest rate. Our empirical analysis yields the following result: first, there is a cointegrated relationship between stock price index and macroeconomic variables in China. Second, the stock index reacts negatively to GDP in short term, but positively in long term. And the change of GDP is one of the reasons for changes in the stock index. But the change of stock index is not the direct reason for the change of GDP. Third, the interest rate and money supply are negatively related to the stock price index. Both of them do not directly cause the change of the stock price index. But the stock index Granger-causes the change of money supply and interest rate.

As one of the most important financial asset prices, the stock price is not only the indicator of economic performance, but can also adjust the status of the economy. The stock price doesn't only affect the stability of the financial sector, but even of the total economy. Therefore, the stock price, macro economy and finance are closely related. Besides, the stock price can also affect the monetary policy, as it may promote or impede the macroeconomic goals. So when the central bank makes monetary policy they should consider about the stock price, and keep the capital, with which the investor invested into the stock market, at a rational level.

However there are also some shortages of this paper: first, the sample is smaller than in previous papers, because the Chinese market is still young and not like the mature stock market in developed countries; second, in the period between second half year in 2006 and the year 2008 the Chinese stock price index fluctuated a lot, which may

not reflect the real development of Chinese stock market very well; third, we only consider about few variables. If we can take more economic variables into our test, like inflation, exchange rate, CPI and so on, then we could get more exact result.

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